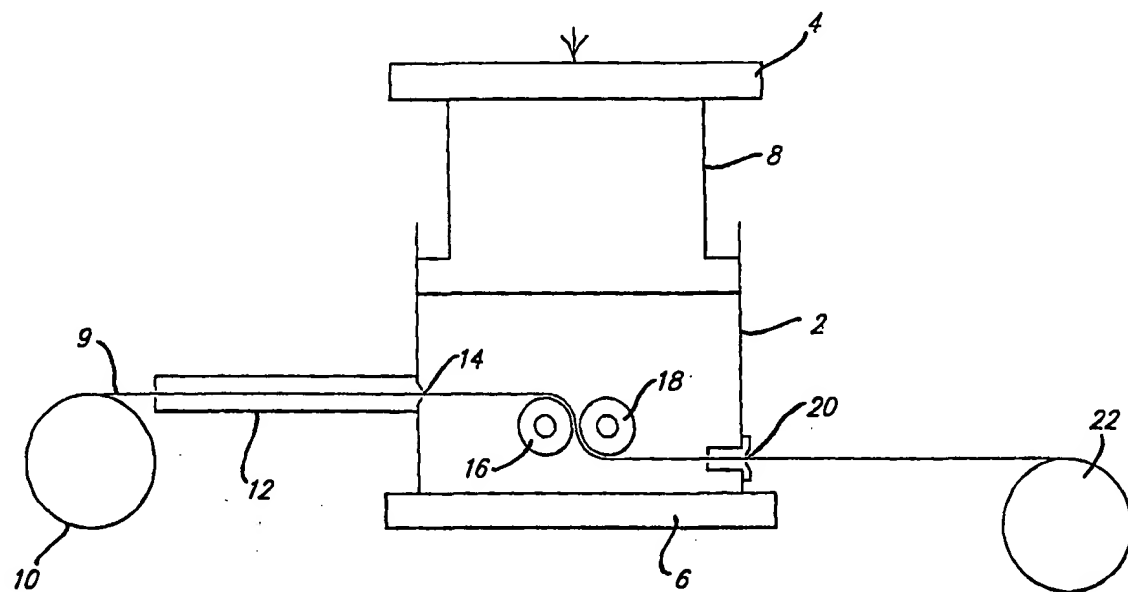


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|   |           |   |
|---|-----------|---|
| <b>(51) International Patent Classification <sup>6</sup>:</b><br><b>B29B 15/12</b>  | <b>A1</b> | <b>(11) International Publication Number:</b> <b>WO 99/02319</b><br><b>(43) International Publication Date:</b> 21 January 1999 (21.01.99)  |
| <b>(21) International Application Number:</b> PCT/US98/14122<br><b>(22) International Filing Date:</b> 8 July 1998 (08.07.98)<br><b>(30) Priority Data:</b><br>08/890,574 9 July 1997 (09.07.97) US<br><b>(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application</b><br>US 08/890,574 (CIP)<br>Filed on 9 July 1997 (09.07.97)<br><b>(71) Applicant (for all designated States except US):</b> BALMER, R., Charles [US/US]; 135 Amelia, Royal Oak, MI 48073 (US).<br><b>(71)(72) Applicant and Inventor:</b> DYKSTERHOUSE, Joel, A. [US/US]; 925 Grove Street, Petoskey, MI 49770 (US).<br><b>(74) Agents:</b> BLAIR, Charles, H. et al.; Harness, Dickey & Pierce, P.L.C., P.O. Box 828, Bloomfield Hills, MI 48303 (US). |           | <b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).<br><br><b>Published</b><br><i>With international search report.</i> |
| <b>(54) Title:</b> METHOD OF PREPREGGING WITH RESIN AND NOVEL PREPREGS PRODUCED BY SUCH METHOD  |           |   |
|   |           |   |
| <b>(57) Abstract</b><br><p>Disclosed is a process of forming a prepreg material having substantially no voids. According to the process of the invention, the reinforcing material is heated to a temperature above the temperature of the impregnating resin. The prepreg formed has substantially no voids and does not require lengthy consolidation when formed into useful articles.</p>   |           |   |

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

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in its capacity as elected Office

|  |  |
|--|--|
| <b>Date of mailing</b> (day/month/year)<br>10 May 1999 (10.05.99)            |  |
| <b>International application No.</b><br>PCT/US98/14122                       | <b>Applicant's or agent's file reference</b><br>405200002PCA     |
| <b>International filing date</b> (day/month/year)<br>08 July 1998 (08.07.98) | <b>Priority date</b> (day/month/year)<br>09 July 1997 (09.07.97) |
| <b>Applicant</b><br>DYKSTERHOUSE, Joel, A.                                   |  |

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

04 February 1999 (04.02.99)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

|  |  |
|--|--|
| <p>The International Bureau of WIPO<br/>34, chemin des Colombettes<br/>1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p> | <p>Authorized officer<br/>Nicola Wolff</p> <p>Telephone No.: (41-22) 338.83.38</p> |
|--|--|

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

|  |  |  |
|--|--|--|
| Applicant's or agent's file reference<br>405200002PCA  | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |  |
| International application No.<br>PCT/US98/14122  | International filing date (day/month/year)<br>08 JULY 1998   | Priority date (day/month/year)<br>09 JULY 1997 |
| International Patent Classification (IPC) or national classification and IPC<br>IPC(6): B29B 15/12 and US Cl.: 264/136; 425/66; 442/50 |  |  |
| Applicant<br>DYKSTERHOUSE, JOEL A.   |  |  |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

|  |  |
|--|--|
| Date of submission of the demand<br><br>04 FEBRUARY 1999   | Date of completion of this report<br><br>20 DECEMBER 1999                              |
| Name and mailing address of the IPEA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231 | Authorized officer<br><br>LEO B. TENTONI<br><br>DEBORAH THOMAS<br>PARALEGAL SPECIALIST |
| Facsimile No. (703) 305-3230   | Telephone No. (703) 308-0661   |

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/14122

**I. Basis of the report**

1. This report has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments):*

☒ the international application as originally filed.

☒ the description, pages 1-23 , as originally filed.

pages NONE , filed with the demand.

pages NONE , filed with the letter of \_\_\_\_\_.

pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_.

☒ the claims, Nos. 1-80 , as originally filed.

Nos. NONE , as amended under Article 19.

Nos. NONE , filed with the demand.

Nos. NONE , filed with the letter of \_\_\_\_\_.

Nos. \_\_\_\_\_ , filed with the letter of \_\_\_\_\_.

☒ the drawings, sheets/~~fig~~ 1-3 , as originally filed.

sheets/~~fig~~ NONE , filed with the demand.

sheets/~~fig~~ NONE , filed with the letter of \_\_\_\_\_.

sheets/~~fig~~ \_\_\_\_\_ , filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

☒ the description, pages NONE .

☒ the claims, Nos. NONE .

☒ the drawings, sheets/~~fig~~ NONE .

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/14122

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. STATEMENT**

|                               |                                      |     |
|-------------------------------|--------------------------------------|-----|
| Novelty (N)                   | Claims <u>1-50, 62-71, 73, 75-77</u> | YES |
|                               | Claims <u>51-61, 72, 74, 78-80</u>   | NO  |
| Inventive Step (IS)           | Claims <u>2, 24, 25, 35, 36</u>      | YES |
|                               | Claims <u>1, 3-23, 26-34, 37-80</u>  | NO  |
| Industrial Applicability (IA) | Claims <u>1-80</u>                   | YES |
|                               | Claims <u>NONE</u>                   | NO  |

**2. CITATIONS AND EXPLANATIONS**

Claims 51-61, 72, 74 and 78-80 lack novelty under PCT Article 33(2) as being anticipated by either Marzocchi et al (U.S. Patent 3,273,987) or Nose et al (U.S. Patent 5,068,142). Marzocchi et al (column 2, line 41 to column 5, line 35) and Nose et al (column 4, line 14 to column 11, line 6) teach a prepreg material and a fiber reinforced article including a fibrous reinforcement impregnated with a resin composition; Marzocchi et al and Nose et al teach an apparatus including a heater and a compressing unit.

Claims 1, 3-23, 26-34, 37-50, 62-71 and 73-77 lack an inventive step under PCT Article 33(3) as being obvious over either Marzocchi et al (U.S. Patent 3,273,987) or Nose et al (U.S. Patent 5,068,142). Marzocchi et al (column 2, line 41 to column 5, line 35) and Nose et al (column 4, line 14 to column 11, line 6) teach a process of, and apparatus for, impregnating a continuous fiber material substantially as set forth in the instant claims, except for the aspect of the continuous fiber material at a tension of at least about 0.25 pound (and means therefor), which would have been obvious to one of ordinary skill in the art at the time the invention was made in either Marzocchi et al or Nose et al principally in order to hold the continuous fiber material taut during impregnation.

Claims 2, 24, 25, 35 and 36 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a process of impregnating a continuous fiber material including the aspect of a dwell time in the bath of less than about ten (10) seconds. The process finds use in the manufacture of aerospace, automotive and sporting goods products.

----- NEW CITATIONS -----

US 5,068,142 A (NOSE ET AL) 26 November 1991, see col. 4, line 14 to col. 11, line 6.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

|  |   |  |
|--|---|--|
| Applicant's or agent's file reference<br><b>405200002PCA</b> | <b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. |  |
| International application No.<br><b>PCT/US 98/ 14122</b>     | International filing date (day/month/year)<br><b>08/07/1998</b>   | (Earliest) Priority Date (day/month/year)<br><b>09/07/1997</b> |
| Applicant<br><b>DYKSTERHOUSE, Joel, A. et al.</b>            |   |  |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (see Box I).
2. ☐ Unity of invention is lacking (see Box II).
3. ☐ The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
  - ☐ filed with the international application.
  - ☐ furnished by the applicant separately from the international application,
    - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
  - ☐ Transcribed by this Authority
4. With regard to the **title**, ☒ the text is approved as submitted by the applicant  
☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract**,
  - ☒ the text is approved as submitted by the applicant
  - ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.
6. The figure of the **drawings** to be published with the abstract is:  
 Figure No. 1 ☒ as suggested by the applicant. ☐ None of the figures.  
☐ because the applicant failed to suggest a figure.  
☐ because this figure better characterizes the invention.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/14122

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B29B15/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B29B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.    |
|------------|---|--------------------------|
| X          | EP 0 393 536 A (TEIJIN LTD)<br>24 October 1990  | 1,52-61                  |
| Y          | see page 6, line 16 - page 7, line 24;<br>figure 6  | 2-38,<br>43-51,<br>62-80 |
| X          | US 3 273 987 A (MARZOCCHI)<br>20 September 1966<br>see column 2, line 49 - column 3, line 19  | 1,52-61                  |
| Y          | GIBSON A G ET AL: "IMPREGNATION<br>TECHNOLOGY FOR THERMOPLASTIC MATRIX<br>COMPOSITES"<br>COMPOSITES MANUFACTURING,<br>vol. 3, no. 4, 1 January 1992, pages<br>223-233, XP000363810<br>see page 227, right-hand column, line 16 -<br>line 34; figures 9,10 | 2-38,<br>43-51,<br>62-80 |

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## ° Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

6 October 1998

Date of mailing of the international search report

14/10/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
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Fax: (+31-70) 340-3016

Authorized officer

Attalla, G

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/14122

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages                             | Relevant to claim No. |
|------------|--|-----------------------|
| A          | WO 95 25000 A (SHELL INT RESEARCH ;VLUG<br>MARC ANDREW (NL)) 21 September 1995<br>see claim 1; figures<br>---- | 37,66                 |
| A          | US 3 993 726 A (MOYER RICHARD L)<br>23 November 1976<br>see figure 4; example 6<br>----                        | 1-80                  |
| A          | EP 0 167 303 A (DU PONT) 8 January 1986<br>see page 5, line 6 - line 20<br>----                                | 1-80                  |
| A          | US 5 540 797 A (WILSON MAYWOOD L)<br>30 July 1996<br>see column 4, line 11 - line 37<br>-----                  | 1-80                  |



## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 98/14122

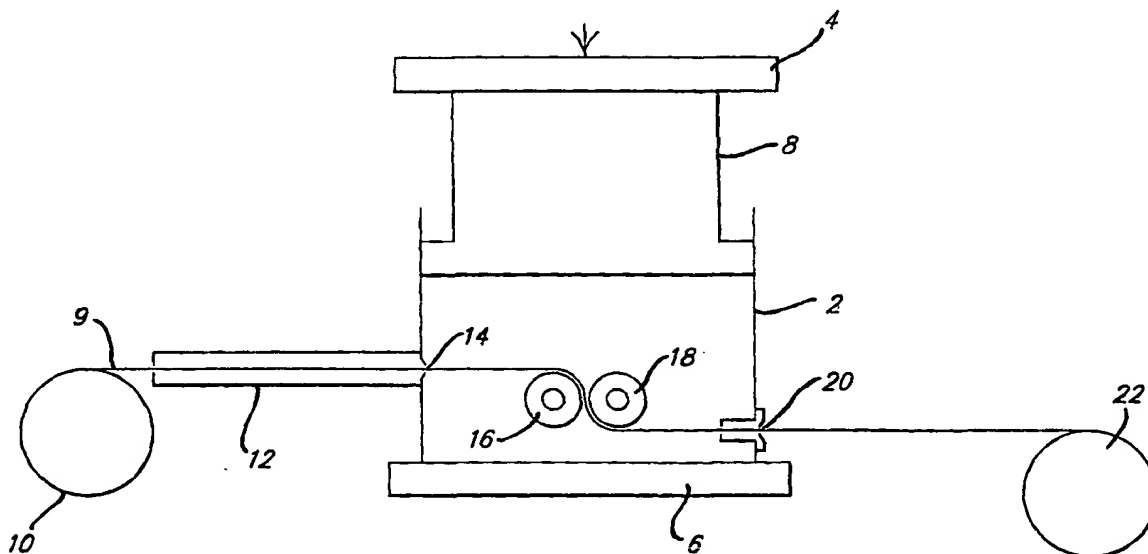
| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s)   | Publication<br>date  |
|---|---|---------------------|--|--|
| EP 0393536                                | A | 24-10-1990          | DE 69025225 D<br>DE 69025225 T<br>US 5068142 A   | 21-03-1996<br>14-11-1996<br>26-11-1991   |
| US 3273987                                | A | 20-09-1966          | NONE   |  |
| WO 9525000                                | A | 21-09-1995          | AU 2109895 A<br>BR 9507071 A<br>CN 1143925 A<br>EP 0756537 A<br>FI 963629 A<br>JP 9510157 T<br>US 5798068 A<br>ZA 9502115 A  | 03-10-1995<br>09-09-1997<br>26-02-1997<br>05-02-1997<br>13-09-1996<br>14-10-1997<br>25-08-1998<br>07-12-1995   |
| US 3993726                                | A | 23-11-1976          | NONE   |  |
| EP 0167303                                | A | 08-01-1986          | US 4640861 A<br>BR 8502659 A<br>CA 1258358 A<br>DE 3562333 A<br>DK 258085 A<br>IE 56538 B<br>JP 2081420 C<br>JP 61040113 A<br>KR 9406643 B<br>PT 80608 B<br>RU 2051033 C<br>US 4720366 A | 03-02-1987<br>12-02-1986<br>15-08-1989<br>01-06-1988<br>08-12-1985<br>28-08-1991<br>23-08-1996<br>26-02-1986<br>25-07-1994<br>30-09-1987<br>27-12-1995<br>19-01-1988 |
| US 5540797                                | A | 30-07-1996          | AU 691104 B<br>AU 5187496 A<br>CA 2215961 A<br>EP 0814950 A<br>WO 9630196 A  | 07-05-1998<br>16-10-1996<br>03-10-1996<br>07-01-1998<br>03-10-1996   |



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|  |  |  |   |
|--|--|--|---|
| (51) International Patent Classification <sup>6</sup> :<br><b>B29B 15/12</b>   |  | <b>A1</b>  | (11) International Publication Number: <b>WO 99/02319</b>       |
|  |  |  | (43) International Publication Date: 21 January 1999 (21.01.99) |
| (21) International Application Number: PCT/US98/14122<br>(22) International Filing Date: 8 July 1998 (08.07.98)<br>(30) Priority Data:<br>08/890,574                      9 July 1997 (09.07.97)                      US<br>(63) Related by Continuation (CON) or Continuation-in-Part<br>(CIP) to Earlier Application<br>US                                      08/890,574 (CIP)<br>Filed on                              9 July 1997 (09.07.97)<br>(71) Applicant (for all designated States except US): BALMER, R.,<br>Charles [US/US]; 135 Amelia, Royal Oak, MI 48073 (US).<br>(71)(72) Applicant and Inventor: DYKSTERHOUSE, Joel, A.<br>[US/US]; 925 Grove Street, Petoskey, MI 49770 (US).<br>(74) Agents: BLAIR, Charles, H. et al.; Harness, Dickey & Pierce,<br>P.L.C., P.O. Box 828, Bloomfield Hills, MI 48303 (US). |  | (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR,<br>BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE,<br>GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ,<br>LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW,<br>MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL,<br>TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO<br>patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian<br>patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European<br>patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR,<br>IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF,<br>CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).<br><br><b>Published</b><br><i>With international search report.</i> |   |

(54) Title: METHOD OF PREPREGGING WITH RESIN AND NOVEL PREPREGS PRODUCED BY SUCH METHOD



## (57) Abstract

Disclosed is a process of forming a prepreg material having substantially no voids. According to the process of the invention, the reinforcing material is heated to a temperature above the temperature of the impregnating resin. The prepreg formed has substantially no voids and does not require lengthy consolidation when formed into useful articles.

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| CI | Côte d'Ivoire            | KP | Democratic People's<br>Republic of Korea | PL | Poland                                       |    |                          |
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| CU | Cuba                     | LC | Saint Lucia                              | RU | Russian Federation                           |    |                          |
| CZ | Czech Republic           | LI | Liechtenstein                            | SD | Sudan  |    |                          |
| DE | Germany                  | LK | Sri Lanka                                | SE | Sweden                                       |    |                          |
| DK | Denmark                  | LR | Liberia                                  | SG | Singapore                                    |    |                          |
| EE | Estonia                  |    |  |    |  |    |                          |